

## Claims

- [c1] A method of forming a plate for the passage through a set of apertures of at least one substance from a first location to a second location comprising the steps of:  
forming two sets of vertical apertures arranged in a array of sample cells in a first layer, with each sample cell containing a member of each of said two sets of vertical apertures;  
forming corresponding sets of vertical apertures connecting to said two sets in at least one corresponding layer;  
forming a set of connecting horizontal apertures in a lower layer disposed below said first and said at least one corresponding layer, in which at least some of said horizontal apertures in said lower layer connect members of said two sets of vertical apertures; and  
assembling said first layer, said at least one corresponding layer and said bottom layer to form a plate containing an array of sample cells containing U-shaped structures.
- [c2] A method according to claim 1, in which said lower layer is disposed above a solid layer forming a bottom surface

of said U-shaped structure.

- [c3] A method according to claim 1, in which said lower layer contains said horizontal aperture and also forms a bottom surface of said U-shaped structure.
- [c4] A method according to claim 1 further comprising a step of:  
bonding said at least two of said layers together, thereby forming said plate.
- [c5] A method according to claim 4, in which said step of bonding said at least two of said layers together, is effected by sintering.
- [c6] A method according to claim 1, in which:  
said steps of forming horizontal and vertical apertures in said at least one of said first, second and third layers are effected by a material removal technique.
- [c7] A method according to claim 1, in which:  
said steps of forming horizontal and vertical apertures in said at least one of said first, second and third layers are effected by a non-material removal technique.
- [c8] A method according to claim 1, in which the layer that forms the bottom surface of the U-shaped structure is a removable layer having an upper surface adapted for

holding sample materials.

- [c9] A method according to claim 1, in which the layer that forms the bottom surface of the U-shaped structure is adapted for passing light.
- [c10] A method according to claim 1, in which the layer that forms the bottom surface of the U-shaped structure is transparent.
- [c11] A method according to claim 9, in which said removable layer is adapted for high speed scanning.
- [c12] A method according to claim 1, in which at least one of said sets of vertical apertures contains removable liners, whereby material adhering to said removable liners may be processed away from said plate.
- [c13] A method according to claim 12, in which at least one of said removable liners is a carrier for a reagent, whereby in operation said reagent reacts with a component of an applied fluid.
- [c14] A method according to claim 12, in which at least one of said sets of vertical apertures is connected to a space for storing rinsing fluid.
- [c15] A method according to claim 12, in which a material adhering to an inner surface of one of said sets of aper-

tures is a carrier for a reagent, whereby in operation said reagent reacts with a substance in an applied fluid.

- [c16] A method according to claim 1, in which said vertical apertures and a reaction region of structures of apertures are adapted such that bubbles rise to a region outside said reaction region.
- [c17] A method according to claim 1, in which a first one of said sets of vertical apertures contains a surface material having a first attraction for capillary action and a second one of said sets of vertical apertures contains a surface material having a second attraction for capillary action, whereby different fluids may be selectively inserted into said first and second sets of vertical apertures.
- [c18] A sample-holding plate containing an array of sample cells for the reaction of reagents in a set of apertures comprising:  
two sets of vertical apertures arranged in said array of sample cells in a first layer, with each sample cell containing a member of each of said two sets of vertical apertures;  
at least one corresponding layer containing sets of corresponding vertical apertures connecting to said two sets of apertures in first layer;  
a bottom layer disposed below said first and said at least

one corresponding layer and containing a set of connecting horizontal apertures, in which said set of connecting horizontal apertures connect at least some members of said two sets of vertical apertures, thereby forming an array of sample cells containing U-shaped structures.

[c19] A sample-holding plate according to claim 18, in which a first one of said vertical apertures comprises a capillary retention valve adapted for storing a quantity of a first reagent; and  
a second one of said vertical apertures is adapted for receiving a second reagent and bringing said second reagent in contact with said first reagent.

[c20] A sample-holding plate according to claim 19, in which said first and second reagents have quantities such that said first and second reagent overlap by a diffusion length of one of said first and second reagents.

[c21] A sample-holding plate according to claim 19, in which the layer that forms the bottom surface of the U-shaped structure is a removable layer having an upper surface adapted for holding sample materials.

[c22] A sample-holding plate according to claim 18, in which the layer that forms the bottom surface of the U-shaped

structure is transparent.

- [c23] A sample-holding plate according to claim 18, in which at least one of said sets of vertical apertures is connected to a space for storing rinsing fluid.
- [c24] A support and handling structure for manipulating a plate containing an array of sample holders comprising:  
alignment means for positioning said plate at a reference location, comprising a set of supports in mechanical contact with said plate; and  
a set of adjusters for moving said set of supports relative to said support frame, whereby said set of supports moves relative to said support frame.
- [c25] A support and handling structure according to claim 24, in which said structure comprises a supporting frame carrying said set of adjusters disposed to shift said set of supports in an X-Y plane and thereby shift said plate in said X-Y plane.
- [c26] A support and handling structure according to claim 25, further comprising means for lifting said plate above said structure so that said plate may be gripped by a material handler.
- [c27] A support and handling structure according to claim 24, in which said supporting frame comprises means for

supplying gaseous pressure to apertures of said sample holders formed in a lower surface of said plate.

[c28] A support and handling structure according to claim 27, in which at least some of said means for supplying gaseous pressure in said supporting frame comprise means for supplying gaseous pressure at less than ambient pressure, whereby fluid disposed in said sample holders flows out of said sample holders into said means for supplying gaseous pressure.

[c29] A support and handling structure according to claim 24, in which said set of supports comprise means for supporting an optical interface above said plate.

[c30] A support and handling structure according to claim 24, in which said supporting frame comprises a lower interface array of a first interface interspersed with a second interface, said first and second interfaces having positions corresponding to positions of said array of sample holders; and  
said supporting frame further comprises means for shifting the relative positions of said plate and said lower interface array such that said first interface meets a first set of said sample holders in a first position and said first interface meets a second set of sample holders in a second position, while said second interface meets said

second set of said sample holders in said first position and said second interface meets said first set of sample holders in said second position, whereby both said first and second interfaces may be applied to all of said set of sample holders by shifting said lower interface.

[c31] A support and handling structure for manipulating a plate containing an array of sample holders comprising: alignment means for positioning the plate at a reference location, comprising a set of supports in mechanical contact with said plate; and a set of interface modules positioned adjacent a lower surface of said plate, each of said set of interface modules containing means for applying gaseous pressure to an aperture in said lower surface of said plate.